I Claim:

1. A method for determining the shape of a scroll cage for a forward-curved centrifugal blower wheel in a blower housing having a blower cut-off end comprising:

determine the blower wheel dimensions (R_{wheel} x blower wheel depth);

calculate ρ_o, the radius of a blower circle, comprising the distance from the center of the blower wheel to the blower cut-off end, using the formula: $\rho_o = R_{wheel} + \delta$, where δ, the radial wheel clearance, is selected from the range of: $10mm \leq \delta \leq 20mm$;

determine ρ_e, the distance from the center of the blower wheel to the discharge point of the scroll cage at the tangential point of the scroll cage and the blower housing, and calculate b, the difference between ρ_e and ρ_o using the formula: $b = \rho_e - \rho_o$;

select a diffusing angle α, the angle between the blower circle and the blower cut-off at the blower cut-off end, from the range of: $8^o < \alpha < 13^o$;

calculate a development angle φ_o, the polar angle between the radial line from the center of the blower wheel to the blower cut-off end and the radial line from the center of the blower wheel to the discharge point, using the formula: $\varphi_o \tan \alpha = (180/\pi)\ (b/\rho_o)$; and

plot the scroll cage profile on polar coordinates starting at the cut-off end using the formula: $\rho = \rho_o + \varphi\ b/\varphi_o$ (for $0 \leq \varphi \leq \varphi_o$) where ρ is the distance from the center of the blower wheel to the scroll cage and ending at the discharge point at $(\varphi_o\ ,\ \rho_e)$.

2. The method for determining the shape of a scroll cage of claim 1 further comprising:

run a simulation of the blower performance for the scroll cage profile plotted;

modify the diffusing angle α, and calculate a new development angle φ_o;

plot a new scroll cage profile using the formula: $\rho = \rho_o + \varphi\ b/\varphi_o$ (for $0 \leq \varphi \leq \varphi_o$); and

run a simulation of blower performance for the new scroll cage plotted to determine which scroll cage profile provides the best blower performance.

3. The method for determining the shape of a scroll cage of claim 2 further comprising:

iteratively repeating the steps of modifying the diffusing angle α, calculating a new development angle φ_o, plotting a new scroll cage profile using the formula: $\rho = \rho_o + \varphi\, b/\varphi_o$ (for $0 \le \varphi \le \varphi_o$), and running a simulation of blower performance for the new scroll cage profiles plotted until optimum blower performance is determined.

4. The method for determining the shape of a scroll cage of claim 1 wherein the formula for plotting the scroll cage profile is: $\rho = \rho_o + b\, \varphi/\varphi_o + \Delta\rho_o\, 4\varphi/\varphi_o\, (1 - \varphi/\varphi_o)$ for $0 \le \varphi \le \varphi_o$, where $\Delta\rho_o$ is the largest additional space that the scroll profile can be extended radially and the value of $\Delta\rho_o$ is in the range: $0 < \Delta\rho_o < 20$ mm.

5. A method for determining the shape of a scroll cage for a forward-curved centrifugal blower wheel in a blower housing having a blower cut-off end comprising:

determine the blower wheel dimensions (R_{wheel} x blower wheel depth);

calculate ρ_o, the radius of a blower circle, comprising the distance from the center of the blower wheel to the blower cut-off end, using the formula: $\rho_o = R_{wheel} + \delta$, where δ, the radial wheel clearance, is selected from the range of: $10\text{mm} \le \delta \le 20\text{mm}$;

determine ρ_e, the distance from the center of the blower wheel to the discharge point of the scroll cage at the tangential point of the scroll cage and the blower housing, and calculate b, the difference between ρ_e and ρ_o using the formula: $b = \rho_e - \rho_o$;

select a diffusing angle α, the angle between the blower circle and the blower cut-off at the blower cut-off end, from the range of: $8^\circ < \alpha < 13^\circ$;

calculate a development angle φ_o, the polar angle between the radial line from the center of the blower wheel to the blower cut-off end and the radial line from the center of the blower wheel to the discharge point, using the formula: $\varphi_o \tan \alpha = (180/\pi)\ (b/\rho_o)$; and

plot the scroll cage profile on polar coordinates starting at the discharge point using the formula: $\rho = \rho_o + (\varphi_o - \varphi)\ b/\varphi_o$ (for $0 \leq \varphi \leq \varphi_o$) where ρ is the distance from the center of the blower wheel to the scroll cage and ending at the blower cut-off end at (φ_o , ρ_o).

6. The method for determining the shape of a scroll cage of claim 5 further comprising:

run a simulation of the blower performance for the scroll cage profile plotted;

modify the diffusing angle α, and calculate a new development angle φ_o;

plot a new scroll cage profile using the formula: $\rho = \rho_o + (\varphi_o - \varphi)\ b/\varphi_o$ (for $0 \leq \varphi \leq \varphi_o$); and

run a simulation of blower performance for the new scroll cage profile plotted to determine which scroll cage profile provides the best blower performance.

7. The method for determining the shape of a scroll cage of claim 6 further comprising:

iteratively repeating the steps of modifying the diffusing angle α, calculating a new development angle φ_o, plotting a new scroll profile using the formula: $\rho = \rho_o + (\varphi_o - \varphi) b/\varphi_o$ (for $0 \leq \varphi \leq \varphi_o$), and running a simulation of blower performance for the new scroll cage profiles plotted until optimum blower performance is determined.

8. The method for determining the shape of a scroll cage of claim 5 wherein the formula for plotting the scroll cage profile is: $\rho = \rho_o + (\varphi_o - \varphi)\ b/\varphi_o + \Delta\rho_o\, 4\varphi/\varphi_o\, (1 - \varphi/\varphi_o)$, for $0 \leq \varphi \leq$

φ_o, where $\Delta\rho_o$ is the largest additional space that the scroll profile can be extended radially and the value of $\Delta\rho_o$ is in the range: $0 < \Delta\rho_o < 20$ mm.

9. A method for determining the shape of a scroll cage of a blower housing having a blower cut-off end for a forward-curved centrifugal blower wheel for use in a room air conditioner comprising:

determine the air flow requirements (*CFM*) for the room air conditioner;

determine the blower wheel dimensions (R_{wheel} x blower wheel depth), blower wheel shaft location and blower housing dimensions based on the room air conditioner performance objectives and cabinet dimensions;

calculate ρ_o, the radius of a blower circle, comprising the distance from the center of the blower wheel to the blower cut-off end, using the formula: $\rho_o = R_{wheel} + \delta$, where δ, the radial wheel clearance, is selected from the range of: $10\text{mm} \leq \delta \leq 20\text{mm}$;

determine ρ_e, the distance from the center of the blower wheel to the discharge point of the scroll cage at the tangential point of the scroll cage and the blower housing, and calculate b, the difference between ρ_e and ρ_o using the formula: $b = \rho_e - \rho_o$;

select a diffusing angle α, the angle between the blower circle and the blower cut-off at the blower cut-off end, from the range of: $8^\circ < \alpha < 13^\circ$;

calculate a development angle φ_o, the polar angle between the radial line from the center of the blower wheel to the blower cut-off end and the radial line from the center of the blower wheel to the discharge point, using the formula: $\varphi_o \tan\alpha = (180/\pi)\ (b/\rho_o)$; and

plot the scroll cage profile on polar coordinates starting at the cut-off end using the formula: $\rho = \rho_o + \varphi\ b/\varphi_o$ (for $0 \leq \varphi \leq \varphi_o$) where ρ is the distance from the center of the blower wheel to the scroll cage and ending at the discharge point at $(\varphi_o\ ,\ \rho_e)$.

10. The method for determining the shape of a scroll cage of claim 9 wherein the formula for plotting the scroll cage profile is: $\rho = \rho_o + b\ \varphi/\varphi_o + \Delta\rho_o\ 4\varphi/\varphi_o\ (1 - \varphi/\varphi_o)$ for $0 \leq \varphi \leq \varphi_o$, where $\Delta\rho_o$ is the largest additional space that the scroll profile can be extended radially and the value of $\Delta\rho_o$ is in the range: $0 < \Delta\rho_o < 20$ mm.

11. The method for determining the shape of a scroll cage of claim 9 wherein a diffusing angle α of 11° is used to calculate the development angle φ_o using the formula: $\varphi_o \tan\alpha = (180/\pi)\ (b/\rho_o)$.

12. The method for determining the shape of a scroll cage of claim 9 wherein a development angle φ_o of 270° is used to plot the scroll profile using the formula: $\rho = \rho_o + \varphi\ b/\varphi_o$ (for $0 \leq \varphi \leq \varphi_o$).

13. The method for determining the shape of a scroll cage of claim 9 wherein a diffusing angle α of 11° and a development angle φ_o of 270° are used to determine b using the formula: $\varphi_o \tan\alpha = (180/\pi)\ (b/\rho_o)$ and to plot the scroll profile using the formula: $\rho = \rho_o + \varphi\ b/\varphi_o$ (for $0 \leq \varphi \leq \varphi_o$).

14. The method for determining the shape of a scroll cage of claim 9 further comprising:

run a computational fluid dynamics (*CFD*) simulation of the blower performance for the scroll cage profile plotted;

confirm a blower wheel having dimensions R_{wheel} x blower wheel depth is capable of producing required airflow (*CFM*) at the design blower wheel rotation speed;

modify the diffusing angle α, and calculate a new development angle φ_o;

plot a new scroll cage profile using the formula: $\rho = \rho_o + \varphi\, b/\varphi_o$ (for $0 \leq \varphi \leq \varphi_o$); and

run a *CFD* simulation of blower performance for the new scroll cage profile plotted to determine which scroll cage profile provides the best blower performance.

15. The method for determining the shape of a scroll cage of claim 14 further comprising:

iteratively repeating the steps of modifying the diffusing angle α, calculating a new development angle φ_o, plotting a new scroll profile using the formula: $\rho = \rho_o + \varphi\, b/\varphi_o$ (for $0 \leq \varphi \leq \varphi_o$), and running a *CFD* simulation of blower performance of new scroll cage profiles plotted until optimum blower performance is determined.

16. A method for determining the shape of a scroll cage of a blower housing having a blower cut-off end for a forward-curved centrifugal blower wheel for use in a room air conditioner comprising:

determine the air flow requirements (*CFM*) for the room air conditioner;

determine the blower wheel dimensions (R_{wheel} x blower wheel depth), blower wheel shaft location and blower housing dimensions based on the room air conditioner performance objectives and cabinet dimensions;

calculate ρ_o, the radius of a blower circle, comprising the distance from the center of the blower wheel to the blower cut-off end, using the formula: $\rho_o = R_{wheel} + \delta$, where δ, the radial wheel clearance, is selected from the range of: $10\text{mm} \leq \delta \leq 20\text{mm}$;

determine ρ_e, the distance from the center of blower wheel to the discharge point of the scroll cage at the tangential point of the scroll cage and the blower housing, and calculate b, the difference between ρ_e and ρ_o using the formula: $b = \rho_e - \rho_o$;

select a diffusing angle α, the angle between the blower circle and the blower cut-off at the blower cut-off end, from the range: $8^\circ < \alpha < 13^\circ$;

calculate a development angle φ_o, the polar angle between the radial line from the center of the blower wheel to the blower cut-off end and the radial line from the center of the blower wheel to the discharge point, using the formula: $\varphi_o \tan \alpha = (180/\pi)\ (b/\rho_o)$; and

plot the scroll cage profile on polar coordinates starting at the discharge point using the formula: $\rho = \rho_o + (\varphi_o - \varphi)\ b/\varphi_o$ (for $0 \leq \varphi \leq \varphi_o$) where ρ is the distance from the center of the blower wheel to the scroll cage and ending at the blower cut-off end at $(\varphi_o\ ,\ \rho_o)$.

17. The method for determining the shape of a scroll cage of claim 16 wherein the formula for plotting the scroll cage profile is: $\rho = \rho_o + (\varphi_o - \varphi)\ b/\varphi_o + \Delta\rho_o\ 4\varphi/\varphi_o\ (1 - \varphi/\varphi_o)$, for $0 \leq \varphi \leq \varphi_o$, where $\Delta\rho_o$ is the largest additional space that the scroll profile can be extended radially and the value of $\Delta\rho_o$ is in the range: $0 < \Delta\rho_o < 20$ mm.

18. The method for determining the shape of a scroll cage of claim 16 further comprising:

run a computational fluid dynamics (*CFD*) simulation of the blower performance for the scroll cage profile plotted;

confirm blower wheel having dimensions R_{wheel} x blower wheel depth is capable of producing required airflow (*CFM*) at the design blower wheel rotation speed;

modify the diffusing angle α, and calculate a new development angle φ_o;

plot a new scroll cage profile using the formula: $\rho = \rho_o + (\varphi_o - \varphi)\ b/\varphi_o$ (for $0 \leq \varphi \leq \varphi_o$); and

run a *CFD* simulation of blower performance for the new scroll cage profile plotted to determine which scroll cage profile provides the best blower performance.

19. The method for determining the shape of a scroll cage of claim 18 further comprising:

iteratively repeating the steps of modifying the diffusing angle α, calculating a new development angle φ_o, plotting a new scroll cage profile using the formula: $\rho = \rho_o + (\varphi_o - \varphi) b/\varphi_o$ (for $0 \leq \varphi \leq \varphi_o$), and running a *CFD* simulation of blower performance of new scroll cage profiles plotted until optimum blower performance is determined.